

CORE VALUES

A new processor can revive an old PC or form the basis of a powerful new one. We test 38 of the latest CPUs

INTRODUCTION

If your PC is struggling with high-definition video, the latest games or even Windows Vista, you should consider buying a new processor. Whether you're upgrading an old PC or building a new one, many of the latest processors provide incredible amounts of computing power for little money.

All modern processors have at least two processing cores, allowing them to undertake multiple tasks with ease, while many have four cores for speeding through demanding tasks. Even the slowest processor in this group test scored a respectable 124 in our *Shopper* benchmarks.

This month we've tested a total of 38 processors to give you a definitive guide. We've covered the full extent of both Intel's and AMD's current processor ranges, with processors for both LGA775 and AM2 motherboards. The cheapest processor on test costs only £36 including VAT, proving that a fast PC doesn't have to cost a fortune.

Seth Barton

Deputy Reviews Editor



seth@computershopper.co.uk

Choosing a... Processor

If you're planning to upgrade your PC, you'll need a processor that matches your current motherboard.

The Intel processors here use socket LGA775; the AMD processors use socket AM2. It's not quite that simple, though, and as newer processors are released, older motherboards won't support them. Check your motherboard's manual before you buy. If you're building a new system, you can choose any processor, as long as you buy a motherboard that supports it.

CORES AND EFFECT

Every processor here has either two or four cores. In effect, these can do the work of two or four older single-core processors running at the same speed. This makes them better at handling multiple tasks such as watching a video while encoding to a CD or MP3.

Many new applications take advantage of multiple cores. These multi-threaded applications use all the cores to reduce the time it takes to perform a task. This explains the very high scores achieved by the quad-core processors in our multi-threaded Video test.

ON THE BUSES

Two factors determine a processor's clock speed: the external bus speed multiplied by the multiplier. Most of the processors here have a 200MHz external bus speed, but Intel's new processors have faster 266MHz or 333MHz bus speeds.

The external bus speed also determines other factors. In Intel processors, the external bus speed is quad-pumped to get the frontside bus (FSB) speed (a 266MHz external bus makes for a 1,066MHz FSB). The FSB talks to other components including the PCI Express bus and system memory, which also has its speed determined as a ratio of the external bus.

AMD processors use HyperTransport instead. This is a direct-connect technology and its speed is based on a multiplier of the external bus. HyperTransport 2.0 runs at a maximum of 1.4GHz, which is a x7 multiplier on the 200MHz external bus. HyperTransport gives dedicated connections to system components, such as the PCI Express bus and system memory. System memory is still linked to the external bus speed, though.

You can increase a processor's speed by increasing the multiplier or external bus speed. Increasing the multiplier is the easiest option, as it affects only the processor's speed; increasing the external bus affects everything that's related to it, such as system memory. This can cause instabilities. Unfortunately, most processors are multiplier locked, so external bus overclocking is your only option. Our reviews tell you which processors are not multiplier locked.

CACHE RICH

Processor speeds alone don't tell you how fast a processor is. Other factors, such as the number of instructions each can perform in a clock cycle (known as its efficiency), play a big part. Accessing system memory can also slow a processor down, so caches are important. A cache stores recently accessed instructions and data in super-fast memory on the processor to cut the number of memory accesses needed. L1 cache is the smallest and fastest type, and each processor core has its own. L2 cache is a little slower and can be shared or dedicated to one core. Only AMD's quad-core Phenom processors use L3 cache, which is shared across all cores. Our reviews tell you how much of each type of cache each processor has, as well as its advantages and disadvantages. For a true view of performance, though, see our benchmark scores on page 119.

INTEL CORE 2 DUO

Most of the dual-core PCs submitted for testing in our labs have Intel Core 2 Duo processors. There's a massive range available, from the 1.8GHz E4300 right up to the 3.16GHz E8500, and we've tested most of them here.

Each core in a Core 2 Duo has its own 64KB L1 cache, which is smaller than those used by AMD's Athlon 64 X2 processors. The L2 cache varies in size, but is always shared by the two cores. This is more efficient when running multi-threaded applications, as data and instructions don't have to be duplicated across two caches.

The Core 2 Duo's architecture makes it more efficient per clock cycle than the Athlon 64 X2, and so it performs better at similar clock speeds. For example, the 2.2GHz Core 2 Duo E4500 is significantly quicker than the 2.2GHz Athlon 64 X2 4200+. If you're looking to compare Intel and AMD processors, then look at benchmark performance rather than clock speeds.

All Core 2 Duo processors use the LGA775 socket. If upgrading, check your motherboard's manual to see which processors it supports. Many older LGA775 motherboard chipsets don't support Core 2 Duo processors, and others need a BIOS update to be compatible.

DIFFERENT RANGES

The 4000 series includes the cheapest Core 2 Duo processors. They use the Allendale core and are manufactured using a 65nm process, making them reasonably power efficient and cool. They run at a 200MHz external bus speed, but as with all Intel processors this is quad-pumped, and is in effect 800MHz. This is the slowest frontside bus speed of all Intel's Core 2 Duo processors. All the 4000 processors have 2,048KB of shared L2 cache, which again is the smallest in this range.

The 6000 series includes some of the original Core 2 Duo processors, such as the E6700. All these processors are based on the Conroe core and use the same 65nm process as the 4000s. Most use a quad-pumped 333MHz (1,066MHz effective) external bus, although newer designs use a quicker 1,333MHz external bus. Check your motherboard's manual to see which external bus speeds it supports, and use the table below to find the right processor.

A faster external bus speed increases the bandwidth available to the processor when it's

talking to other system components, such as memory and the PCI Express bus. Quicker speeds can increase performance, as shown by the E6550's better benchmark score over that of the E6600 in our Multitasking test, despite the E6600's slightly higher clock speed.

All the 6000-series processors have large 4,096KB L2 caches. The 6000 series includes the Core 2 Extreme X6800, which has an unlocked multiplier that lets you overclock easily and more stably by not having to adjust the external bus speed.

The new 8000 series includes the quickest dual-core processor available: the E8500. All 8000-series processors are manufactured using a 45nm process, making them more power efficient and cooler. They all have an external bus speed of 1,333MHz. A large 6,144KB L2 cache is shared between both cores, improving the processor's performance by reducing the

number of times it has to access the system memory.

SPECIFIC PROCESSORS

The Core 2 Duo range has a lot to offer, whether you're building a new PC or upgrading an old one. The Core 2 Duo E4500 and E4600 are good choices, but you can ignore the slower E4300 and E4400 processors, as the Pentium Dual Core E2180 and E2200 are better value.

The 6000 series is showing its age. Many of these processors look pricy next to the 4000 series, and the rest are outperformed by the 8000 series. If your motherboard won't support processors with a 1,333MHz external bus speed, though, the E6420 is your best option.

The 8000 series is very impressive. The E8400 costs only £19 more than the cheapest 6000-series processor, but produced one of the highest scores here for a dual-core processor. The E8500 is faster still, but doesn't justify its higher price when compared with the E8400.



Crisis testing Shopper application tests

All the processors ran our Call of Duty 2 benchmark without a problem, receiving very similar scores. Because of this, we decided to give our favourites a more demanding test using EA's Crysis. We ran a quick benchmark at three different settings on a powerful ATI Radeon HD3870 X2 graphics card.

At the lowest settings, we found that the E1200 and E2160 were limiting the frame rate. It was less pronounced on the middle setting, although a faster processor was still

necessary to get the most out of the graphics card. At the highest setting the graphics card became the limiting factor for everything except the E1200.

If you're planning to buy a fast graphics card, we recommend that you buy our Best Buy processor, the Core 2 Duo E8400. The E2160, our Budget Buy, is fine for casual gamers, but we'd avoid the E1200 if you want to play 3D games. There's currently no reason to buy a quad-core processor for games alone.

Processor gaming test (average score in frames per second)

PROCESSOR	1,024x768 LOW DETAIL	1,280x1,024 MEDIUM DETAIL	1,600x1,200 HIGH DETAIL
Intel Core 2 Extreme QX9650	103.5	53.5	31.3
Intel Core 2 Duo E8400	102.3	46.9	31.6
Intel Pentium Dual Core E2160	62.2	37.4	30.9
Intel Celeron Dual Core E1200	36.9	29.4	15.6

MODEL	SPEED	MULTIPLIER	EXTERNAL BUS	L2 CACHE	SHOPPER OVERALL	PRICE INC VAT
Core 2 Duo E4300	1.8GHz	x9	200MHz	2,048KB	146	£74
Core 2 Duo E4400	2.0GHz	x10	200MHz	2,048KB	158	£82
Core 2 Duo E4500	2.2GHz	x11	200MHz	2,048KB	173	£82
Core 2 Duo E4600	2.4GHz	x12	200MHz	2,048KB	186	£92
Core 2 Duo E6320	1.86GHz	x7	266MHz	4,096KB	153	£109
Core 2 Duo E6420	2.13GHz	x8	266MHz	4,096KB	172	£116
Core 2 Duo E6550	2.33GHz	x7	333MHz	4,096KB	191	£103
Core 2 Duo E6600	2.4GHz	x9	266MHz	4,096KB	182	£147
Core 2 Duo E6700	2.66GHz	x10	266MHz	4,096KB	190	£184
Core 2 Duo E6750	2.66GHz	x8	333MHz	4,096KB	211	£118
Core 2 Duo E6850	3.0GHz	x9	333MHz	4,096KB	229	£168
Core 2 Duo E8200	2.66GHz	x8	333MHz	6,144KB	225	£118
Core 2 Duo E8400	3.0GHz	x9	333MHz	6,144KB	250	£125
Core 2 Duo E8500	3.16GHz	x9.5	333MHz	6,144KB	261	£177
Core 2 Extreme X6800	2.93GHz	x11	266MHz	4,096KB	197	£606

INTEL CORE 2 QUAD

Intel's Core 2 Quad processors have four cores, which makes them ideal if you want to run many applications simultaneously. Alternatively, by using multi-threaded applications, such as our Video test, you can put all four cores to work on a single task. This gives impressive results, reducing the processing time to a fraction of what was possible with a single core processor.

A Core 2 Quad processor is basically two Core 2 Duo processors stuck together. Each half has its own L2 cache, which is shared by both cores. However there's no unifying L3 cache, as found on AMD's Phenom processors, so data may have to be duplicated across both caches.

DIFFERENT RANGES

The 6000 series of processors have a Kentsfield core and were Intel's first desktop quad-core

processors. They are manufactured using a 65nm process and have an external bus speed of 1,066MHz, just like many of the 6000-series Core 2 Duos. Each pair of cores has a 4,096KB shared L2 cache, just like each processor core in the 6000-series Core 2 Duos.

The newer 9000 series of processors uses a Yorkfield core, which is manufactured using a smaller 45nm process. This makes it more power efficient and cooler in operation. They have a quicker 1,333MHz external bus speed, too. Most have a pair of massive 6,144KB L2 caches – the biggest we've ever seen – but Intel's latest Core 2 Quad processor, the Q9300, has only half this amount, sharing 3,072KB between each pair of cores.



SPECIFIC PROCESSORS

The Core 2 Extreme QX9650 is the fastest Core 2 Quad processor on paper, and was also the fastest chip in our benchmarks. Its Extreme branding means that the multiplier is unlocked, making it more flexible for overclockers, who will want to push it faster still. However, at £642 inc VAT it's simply too expensive for most.

Compared with its Extreme sibling, the Q9550 is more reasonably priced at £370 including VAT. However the Q9450 is almost as fast and costs just £204 including VAT. If you're looking for a quad-core processor, this is the one we recommend. The Q9300 is expensive at present given its smaller cache size. It's very new, though, and prices can fall quickly, so it's worth checking the latest prices before ruling it out.

MODEL	SPEED	MULTIPLIER	EXTERNAL BUS	L2 CACHE	SHOPPER OVERALL	PRICE INC VAT
Core 2 Quad Q6600	2.4GHz	x9	266MHz	8,192KB	250	£157
Core 2 Quad Q6700	2.66GHz	x10	266MHz	8,192KB	276	£329
Core 2 Quad Q9300	2.5GHz	x7.5	333MHz	6,144KB	270	£190
Core 2 Quad Q9450	2.66GHz	x8	333MHz	12,288KB	297	£204
Core 2 Quad Q9550	2.83GHz	x8.5	333MHz	12,288KB	313	£370
Core 2 Extreme QX9650	3.0GHz	x9	333MHz	12,288KB	316	£642

INTEL PENTIUM DUAL CORE

Despite the Pentium name, this range of processors has more in common with the Core 2 Duo 4000 series than it does with Intel's older processors. Equipped with the same Allendale core as the Core 2 Duo 4000, a Pentium Dual Core processor offers all the advantages of Core 2 Duo processors, including a shared cache and highly efficient architecture.

All Pentium Dual Core processors have a 200MHz external bus speed, which is quad-pumped to an effective 800MHz. Multipliers

range from x8 to x11, with clock speeds from the slowest E2140 at 1.6GHz up to the E2200 processor at a speedy 2.2GHz.

Pentium Dual Core processors have a 1,024KB shared L2 cache. This is half that of the Core 2 Duo 4000-series processors, but twice that of the Celeron Dual Core E1200. In our tests they performed as expected, with slightly lower benchmark scores than the equivalent 4000-series processors.



If you're looking for a budget processor, a Pentium Dual Core is a great choice. The E2140 isn't worth bothering with, as the quicker E2160 is available for a similar price. It's the best of the lot with a great price-to-performance ratio. If you want something a little faster then both the E2180 and E2200 are both good choices, and a little quicker than the equivalently priced AMD Athlon X2 processors.

MODEL	SPEED	MULTIPLIER	EXTERNAL BUS	L2 CACHE	SHOPPER OVERALL	PRICE INC VAT
Pentium Dual Core E2140	1.6GHz	x8	200MHz	1,024KB	130	£43
Pentium Dual Core E2160	1.8GHz	x9	200MHz	1,024KB	142	£44
Pentium Dual Core E2180	2.0GHz	x10	200MHz	1,024KB	152	£51
Pentium Dual Core E2200	2.2GHz	x11	200MHz	1,024KB	159	£58

INTEL CELERON DUAL CORE

Intel has been using the Celeron brand on budget products for years, but this doesn't mean all the processors that use it are technically similar. This latest incarnation of the Celeron, the E1200, is based on the same Allendale core as the Pentium Dual Core and Core 2 Duo 4000 series.

Like those more expensive processors, the E1200 uses an 800MHz quad-pumped external bus. An x8 multiplier gives a respectable clock

speed of 1.6GHz, which is the same as that of the Pentium Dual Core E2140. However, the E1200 has only half the L2 cache of the E2140. This means both cores share a tiny 512KB cache between them. Our tests showed that the small cache made the E1200 only a little slower than the otherwise identical E2140.



The E1200 is the cheapest processor on test at just £36 including VAT. If you're looking to upgrade an LGA775-equipped PC, or want to build a budget PC with an eye to upgrading later, the E1200 is a good choice. However, both AMD's Athlon 64 X2 4200+ and the Pentium Dual Core E2160 are better deals, as they're a lot quicker and cost only a little more.

MODEL	SPEED	MULTIPLIER	EXTERNAL BUS	L2 CACHE	SHOPPER OVERALL	PRICE INC VAT
Celeron Dual Core E1200	1.6GHz	x8	200MHz	512KB	124	£36

AMD ATHLON 64

Athlon 64 X2s make up most of AMD's processors line-up. They range in speed from 2.2GHz up to 3.4GHz, and we've tested all the models on the market that AMD currently produces. However, make sure you check the part code when buying any of these processors, as some retailers may still be selling older versions with subtly different specifications.

All the current Athlon 64 X2 processors use the AM2 processor socket. Because of this they have an array of delicate pins on the underside of the processor. This makes them more vulnerable to damage than Intel's LGA775 processors, so you should handle them with the utmost care.

All Athlon 64 X2 processors have two processing cores. Each core has its own 128KB L1 cache, twice the size of those on Intel's processors. This means the core can access more data and instructions at high speed. However, Athlon 64 X2 processors also use separate L2 caches for each core. This means that commonly accessed information must be duplicated across both caches, which is less efficient than Intel's shared cache approach.

While Intel processors use a memory controller on the motherboard, AMD processors have one built into the processor itself. This

should speed up memory access by eliminating a potential bottleneck, and the 2,000MHz external bus speed is certainly impressive. However, this system locks the processor to using a particular type of memory, and so Athlon 64 X2 chips are compatible with only DDR2 memory.

DIFFERENT RANGES

All the processors from the 4200+ up to the 5200+ use the Brisbane core. This is manufactured using a 65nm process, which should make these processors fairly power efficient. However, Athlon 64 X2 processors use higher clock speeds to achieve the same results as Intel processors, and in doing so they use more power and generate more heat.

Each core has its own 512KB cache, which makes a total of 1,024KB. However, the larger L1 caches, quicker memory access and separate cache design make it hard to compare the processors directly with Intel's.

The faster processors in the range, starting with the 5600+, are based on the older Windsor core. This uses a 90nm manufacturing process, which means that these processors tend to run hotter and use more power than most others here. These processors also have larger L2 caches, with 1,024KB per core.



SPECIFIC PROCESSORS

All the AMD Athlon 64 X2 processors that are based on a Brisbane core offer good value, and the 4200+ is particularly outstanding. The Athlon 64 X2 5000+ Black Edition is a good choice if you plan to overclock your processor. Like Intel's Extreme processors, it has an unlocked multiplier, which makes overclocking easier. However, unlike the Extreme processors it isn't ridiculously expensive and costs just £69 including VAT – the same price as the standard 5000+.

Unless you want to upgrade an AM2-based computer, the Windsor-core processors offer very little to get excited about. Each processor is surpassed in our overall benchmarks by an Intel processor of a similar price. Even if you are upgrading an older PC, you should be wary of spending a large amount of money for relatively modest performance gains.

MODEL	SPEED	MULTIPLIER	EXTERNAL BUS	L2 CACHE	SHOPPER OVERALL	PRICE INC VAT
Athlon 64 X2 4200+	2.2GHz	x11	200MHz	2x 512KB	142	£43
Athlon 64 X2 4400+	2.3GHz	x11.5	200MHz	2x 512KB	148	£50
Athlon 64 X2 4800+	2.5GHz	x12.5	200MHz	2x 512KB	158	£58
Athlon 64 X2 5000+	2.6GHz	x13	200MHz	2x 512KB	162	£68
Athlon 64 X2 5000+ Black Edition	2.6GHz	x13	200MHz	2x 512KB	162	£68
Athlon 64 X2 5200+	2.7GHz	x13.5	200MHz	2x 512KB	168	£71
Athlon 64 X2 5600+	2.8GHz	x14	200MHz	2x 1,024KB	181	£89
Athlon 64 X2 6000+	3.0GHz	x15	200MHz	2x 1,024KB	189	£109
Athlon 64 X2 6400+	3.2GHz	x16	200MHz	2x 1,024KB	194	£116

AMD PHENOM

AMD recently launched its first desktop quad-core processor, Phenom. The company has been keen to stress that Phenom is the first 'true' quad-core design on the market, as Intel's Core 2 Quad processors are essentially two dual-core processors in a single package. It uses a third level of memory cache, called L3, which all four cores can access. This makes the Phenom more flexible than an Intel Core 2 Quad, which uses two separate caches for each pair of cores. In addition, each core has a separate 512KB L2 cache and 128KB L1 cache.

Although Phenom is compatible with AM2 motherboards, check with your motherboard manufacturer to make sure. You are going to need an AM2+ motherboard to get the best from these processors, though. These will use HyperTransport 3, which is the link between the

processor and other system components. This runs at 2.6GHz, whereas older boards run at 1.4GHz.

Despite this fast link, the processor's external bus speed is still 200MHz, so high multipliers are required to achieve respectable clock speeds. These first Phenom processors run at either 2.2GHz or 2.3GHz, slower than any of the current Intel Core 2 Quad range. This means these early Phenoms aren't in direct competition with Intel's fastest quad-core processors, but instead offer a budget alternative.

Despite being AMD's latest processor, the Phenom is manufactured using a 65nm process, so it's unlikely to be as power efficient as Intel's latest 45nm processors. This also means that the processors will get hotter, which can limit clock speeds when overclocking.



The Phenom 9500 and 9600 are essentially identical, except for the 9600's slightly higher clock speed. However, this doesn't justify its higher price. The 9600 Black Edition has an unlocked multiplier, which gives additional flexibility when overclocking. If you're looking to upgrade an AM2-based PC to quad-core, the Phenom 9500 is the best choice. Those building a new quad-core PC would be better off buying an Intel processor and motherboard.

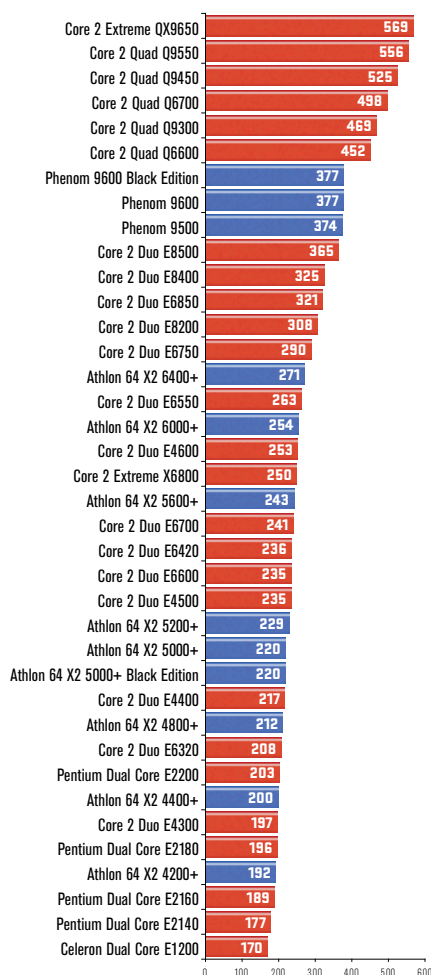
MODEL	SPEED	MULTIPLIER	EXTERNAL BUS	L2 CACHE	SHOPPER OVERALL	PRICE INC VAT
Phenom 9500	2.2GHz	x11	200MHz	4x 512KB	206	£121
Phenom 9600	2.3GHz	x11.5	200MHz	4x 512KB	209	£141
Phenom 9600 Black Edition	2.3GHz	x11.5	200MHz	4x 512KB	209	£144

BENCHMARKS

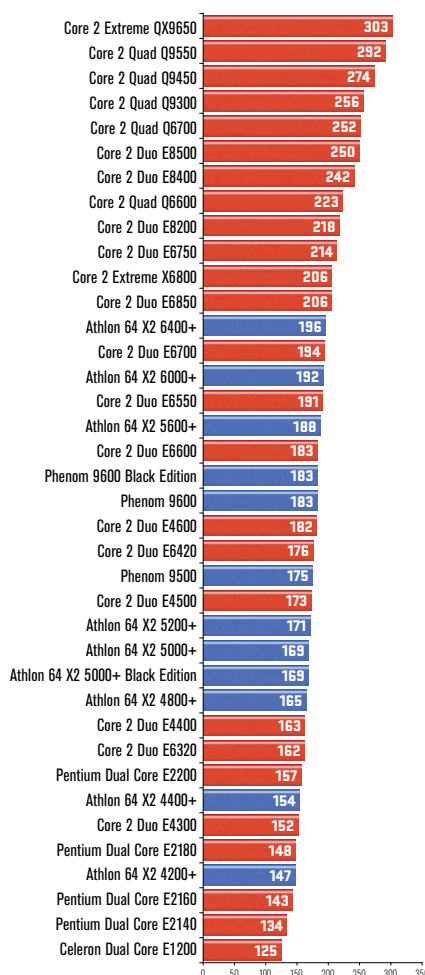


2D Performance Shopper application tests

Video-Encoding



Multitasking



Overall

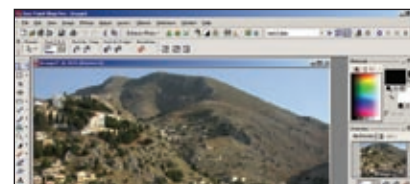


Computer Shopper's 2D benchmarks have been designed to show how PCs stand up to the toughest tasks Windows can throw at them. Today's PCs have no problem running office applications such as Word and Excel, so we have chosen to focus our tests on areas where you could experience difficulties.

Encoding a short video to MPEG2 format is a processor-intensive task that anyone transferring home videos to DVD will have

to tackle. Our image-editing test simulates a session of photo enhancement using Paint Shop Pro X. In our third test, a set of audio files is ripped to MP3 format.

Finally, we have a multitasking test designed to test the benefits of Hyper-Threaded and dual-core processors. This test compresses a DVD at the same time as running our image-editing test. Figures are relative to a reference Evesham Athlon 64 3500+, which scores 100 in all tests.



SETTINGS We run our application tests at 1,280x1,024 resolution and in 32-bit colour
WEB www.computershopper.co.uk

Labs verdict Processors

With so many processors at such a wide variety of prices, we had plenty of contenders for our awards. But after much deliberation we've chosen three that offer outstanding performance for your money.

Our Budget Buy was the most intensely contested award, with processors from both Intel and AMD making our shortlist. The Intel Celeron Dual Core E1200 gets a recommendation, as it's ideal for day-to-day tasks and costs very little. The AMD Athlon 64 X2 4200+ came a very close second, with a great overall benchmark score of 142 for only £43 including VAT. However, the Pentium Dual Core E2160 is our Budget Buy

winner. With an identical overall score and a price difference of only £1, there's little to choose between these last two, but if you're building a new PC, an LGA775 motherboard should offer a better range of upgrades in the future, so the Intel processor is a better choice.

Despite having 29 dual-core processors in this lab, choosing the winner of our first Best Buy award wasn't hard. Intel's 8000 series of Core 2 Duos are extremely quick, and one in particular is great value, too. The E8400 scored an impressive 249 overall in our benchmarks, yet it costs only £125 including VAT. If you're building a new Intel PC and don't need a quad-core processor, it's a superb choice.

If you regularly perform complex tasks such as video encoding, a quad-core processor will justify its cost. Our Ultimate award winner is the Intel Core 2 Quad Q9450. It's quick in both single and multi-threaded applications, and will speed through any task. Amazingly, it costs just £204 including VAT.

If you're upgrading and have an LGA775 motherboard that supports only Intel processors with an external bus of 1,066MHz, the Intel Core 2 Duo E6420 is the best option. For AM2-based upgrades, we recommend the AMD Phenom 9500, which costs as little as £121. The Athlon 64 X2 5000+ Black Edition is a good choice for those on a budget.



PROCESSORS

COMPUTER SHOPPER
BUDGET BUY

MANUFACTURER	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL
Model	Celeron Dual Core E1200	Pentium Dual Core E2140	Pentium Dual Core E2160	Pentium Dual Core E2180	Pentium Dual Core E2200	Core 2 Duo E4300	Core 2 Duo E4400	Core 2 Duo E4500	Core 2 Duo E4600	Core 2 Duo E6550
Core	Allendale	Allendale	Allendale	Allendale	Allendale	Allendale	Allendale	Allendale	Allendale	Conroe
Rating	★★★★★	★★★	★★★★★	★★★★★	★★★★★	★★★	★★★	★★★★★	★★★★★	★★★★★
Frequency	1.6GHz	1.6GHz	1.8GHz	2.0GHz	2.2GHz	1.8GHz	2.0GHz	2.2GHz	2.4GHz	2.33GHz
Socket	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775
Process	65nm	65nm	65nm	65nm	65nm	65nm	65nm	65nm	65nm	65nm
Cores	Two	Two	Two	Two	Two	Two	Two	Two	Two	Two
Instructions	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T
Multiplier	x8	x8	x9	x10	x11	x9	x10	x11	x12	x7
External bus	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	200MHz (800MHz quad-pumped FSB)	333MHz (1.333MHz quad-pumped FSB)
Level 1 cache	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB
Level 2 cache	512KB (2x 256KB shared)	1,024KB (2x 512KB shared)	1,024KB (2x 512KB shared)	1,024KB (2x 512KB shared)	1,024KB (2x 512KB shared)	2,048KB (cores one and two 2,048KB shared)	2,048KB (cores one and two 2,048KB shared)	2,048KB (cores one and two 2,048KB shared)	2,048KB (cores one and two 2,048KB shared)	4,096KB (cores one and two 4,096KB shared)
Level 3 cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Supported memory type	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3
Price including VAT	£36	£43	£44	£51	£58	£74	£82	£82	£92	£106
Supplier	www.pcnextday.co.uk	www.pcnextday.co.uk	www.pcnextday.co.uk	www.pcnextday.co.uk	www.pcnextday.co.uk	www.edipse.com	www.micom.co.uk	www.rsupplies.co.uk	www.rsupplies.co.uk	www.aria.co.uk
Details	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com
Part code	BX80557E1200	BX80557E2140	BX80557E2160	BX80557E2180	BX80557E2200	BX80557E4300	BX80557E4400	BX80557E4500	BX80557E4600	BX80557E6550

COMPUTER SHOPPER
BEST BUY

MANUFACTURER	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL
Model	Core 2 Duo E6320	Core 2 Duo E6420	Core 2 Duo E6200	Core 2 Duo E6750	Core 2 Duo E8400	Core 2 Duo E6600	Core 2 Quad Q6600	Core 2 Duo E6850	Core 2 Duo E8500	Core 2 Duo E6700
Core	Conroe	Conroe	Wolfdale	Conroe	Wolfdale	Conroe	Kentsfield	Conroe	Wolfdale	Conroe
Rating	★★★	★★★★★	★★★	★★★	★★★★★	★★★	★★★★★	★★★	★★★	★★★
Frequency	1.86GHz	2.13GHz	2.66GHz	2.66GHz	3.0GHz	2.4GHz	2.4GHz	2.4GHz	3.16GHz	2.66GHz
Socket	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775
Process	65nm	65nm	65nm	65nm	65nm	65nm	65nm	65nm	45nm	65nm
Cores	Two	Two	Two	Two	Two	Two	Four	Two	Two	Two
Instructions	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T
Multiplier	x7	x8	x8	x8	x9	x9	x9	x9	x9.5	x10
External bus	266MHz (1,066MHz quad-pumped FSB)	266MHz (1,066MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	266MHz (1,066MHz quad-pumped FSB)	266MHz (1,066MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	266MHz (1,066MHz quad-pumped FSB)
Level 1 cache	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	2x 64KB	4x 64KB	2x 64KB	2x 64KB	2x 64KB
Level 2 cache	4,096KB (cores one and two 4,096KB shared)	4,096KB (cores one and two 4,096KB shared)	6,144KB (cores one and two 6,144KB shared)	4,096KB (cores one and two 4,096KB shared)	6,144KB (cores one and two 6,144KB shared)	4,096KB (cores one and two 4,096KB shared)	8,192KB (cores one and two 4,096KB shared, cores three and four 4,096KB shared)	4,096KB (cores one and two 4,096KB shared)	6,144KB (cores one and two 6,144KB shared)	4,096KB (cores one and two 4,096KB shared)
Level 3 cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Supported memory type	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3
Price including VAT	£109	£116	£118	£118	£125	£147	£157	£168	£177	£184
Supplier	www.scan.co.uk	www.aria.co.uk	www.pcnextday.co.uk	www.eurowide-pc.co.uk	www.kikatek.com	www.eurowide-pc.co.uk	www.aria.co.uk	www.edipse.com	www.pcnextday.co.uk	www.baztex.com
Details	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com
Part code	BX80557E6320	BX80557E6420	BX80570E8200	BX80557E6750	BX80570E8400	BX80557E6600	BX80562Q6600	BX80557E6850	BX80570E8500	BX80557E6700

COMPUTER SHOPPER
ULTIMATE

MANUFACTURER	INTEL	INTEL	INTEL	INTEL	INTEL	INTEL	AMD	AMD	AMD
Model	Core 2 Quad Q9300	Core 2 Quad Q9450	Core 2 Quad Q6700	Core 2 Quad Q9550	Core 2 Extreme X6800	Core 2 Extreme QX9650	Athlon 64 X2 4200+	Athlon 64 X2 4400+	Athlon 64 X2 4800+
Core	Yorkfield	Yorkfield	Kentsfield	Yorkfield	Conroe	Yorkfield	Brisbane	Brisbane	Brisbane
Rating	★★★★	★★★★★	★★	★★★★	★★	★★	★★★★★	★★★★★	★★★★★
Frequency	2.5GHz	2.66GHz	2.66GHz	2.83GHz	2.93GHz	3.0GHz	2.2GHz	2.3GHz	2.5GHz
Socket	LGA775	LGA775	LGA775	LGA775	LGA775	LGA775	AM2	AM2	AM2
Process	45nm	45nm	65nm	45nm	45nm	45nm	65nm	65nm	65nm
Cores	Four	Four	Four	Four	Two	Four	Two	Two	Two
Instructions	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, SSE, SSE2, SSE3, SSE4, EM64T	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64
Multiplier	x7.5	x8	x10	x8.5	x11	x9	x11	x11.5	x12.5
External bus	333MHz (1,333MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	266MHz (1,066MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	266MHz (1,066MHz quad-pumped FSB)	333MHz (1,333MHz quad-pumped FSB)	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)
Level 1 cache	4x 64KB	4x 64KB	4x 64KB	4x 64KB	2x 64KB	4x 64KB	2x 128KB	2x 128KB	2x 128KB
Level 2 cache	6,144KB (cores one and two 3,072KB shared, cores three and four 3,072KB shared)	12,288KB (cores one and two 6,144KB shared, cores three and four 6,144KB shared)	8,192KB (cores one and two 4,096KB shared, cores three and four 4,096KB shared)	12,288KB (cores one and two 6,144KB shared, cores three and four 6,144KB shared)	4,096KB (cores one and two 4,096KB shared)	12,288KB (cores one and two 6,144KB shared, cores three and four 6,144KB shared)	2x 512KB	2x 512KB	2x 512KB
Level 3 cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Supported memory type	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2, DDR3	DDR2	DDR2	DDR2
Price including VAT	£190	£204	£329	£370	£606	£642	£43	£50	£58
Supplier	www.pcnextday.co.uk	www.lambda-tek.com/components	www.scan.co.uk	www.pcnextday.co.uk	www.scan.co.uk	www.pcnextday.co.uk	www.rsupplies.co.uk	www.rsupplies.co.uk	www.rsupplies.co.uk
Details	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.intel.com	www.amd.com	www.amd.com	www.amd.com
Part code	BX80580Q9300	BX80569Q9450	BX80562Q6700	BX80569Q9550	BX80557X6800	BX80569Q9650	ADO4200DBOX	ADO4400DBOX	ADO4800DBOX

AMD PROCESSORS

MANUFACTURER	AMD	AMD	AMD	AMD	AMD	AMD	AMD	AMD	AMD
Model	Athlon 64 X2 5000+	Athlon 64 X2 5000+ Black Edition	Athlon 64 X2 5200+	Athlon 64 X2 5600+	Athlon 64 X2 6000+	Athlon 64 X2 6400+	Phenom 9500	Phenom 9600	Phenom 9600 Black Edition
Core	Brisbane	Brisbane	Brisbane	Windsor	Windsor	Windsor	Agna	Agna	Agna
Rating	★★★★	★★★★★	★★★★	★★★★	★★★★	★★★★	★★★★★	★★★★	★★★★
Frequency	2.6GHz	2.6GHz	2.7GHz	2.8GHz	3.0GHz	3.2GHz	2.2GHz	2.3GHz	2.3GHz
Socket	AM2	AM2	AM2	AM2	AM2	AM2	AM2+	AM2+	AM2+
Process	65nm	65nm	65nm	90nm	90nm	90nm	65nm	65nm	65nm
Cores	Two	Two	Two	Two	Two	Two	Four	Four	Four
Instructions	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, SSE4a, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, SSE4a, x86-64	MMX, 3DNow!+, SSE, SSE2, SSE3, SSE4a, x86-64
Multiplier	x13	x13	x13.5	x14	x15	x16	x11	x11.5	x11.5
External bus	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)	200MHz (2,000MHz HyperTransport)	200MHz (3,600MHz HyperTransport)	200MHz (3,600MHz HyperTransport)	200MHz (3,600MHz HyperTransport)
Level 1 cache	2x 128KB	2x 128KB	2x 128KB	2x 128KB	2x 128KB	2x 128KB	4x 128KB	4x 128KB	4x 128KB
Level 2 cache	2x 512KB	2x 512KB	2x 512KB	2x 1,024KB	2x 1,024KB	2x 1,024KB	4x 512KB	4x 512KB	4x 512KB
Level 3 cache	N/A	N/A	N/A	N/A	N/A	N/A	2,048KB shared	2,048KB shared	2,048KB shared
Supported memory type	DDR2	DDR2	DDR2	DDR2	DDR2	DDR2	DDR2	DDR2	DDR2
Price including VAT	£68	£68	£71	£89	£109	£116	£121	£141	£144
Supplier	www.rsupplies.co.uk	www.rsupplies.co.uk	www.dabs.com	www.aria.co.uk	www.rsupplies.co.uk	www.rsupplies.co.uk	www.aria.co.uk	www.eurowide-pc.co.uk	www.lambda-tek.com/components
Details	www.amd.com	www.amd.com	www.amd.com	www.amd.com	www.amd.com	www.amd.com	www.amd.com	www.amd.com	www.amd.com
Part code	ADA5000CSBOX	ADO5000DSWOF	ADO5200DOBOX	ADA5600CZBOX	ADA6000CZBOX	ADX6400CZBOX	HD9500WCGDBOX	HD9600WCGDBOX	HD9602WCGDBOX